kind) beaten back by the trade winds would probably never get poleward of the Tropics if it were not for the arrest of these winds by continental friction. This friction often becomes effective some distance to the eastward over the ocean by damming back the trades. It thus happens that cyclones are often carried poleward by the antitrades [prevailing westerlies?], and started on their eastward journey while still some distance out at sea, as on the coast of Florida, Australia, etc.

BAROMETRIC PRESSURE AND EARTH PULSATION.[1]

By N. Shimono, Japan.

According to Professor Omori pulsation of the earth is due to changes in the pressure upon the earth's crust and these are mostly caused by barometric depressions, or by changes in sea-level when the latter occurs, but not to the wind itself. The following is the result of our investigations into the relation between barometric depressions and the earth's pulsation as observed in the vicinity of Osaka. On the morning of the 4th of August, 1908, a barometric depression made its appearance at sea far to the south of Ishigakijima, and it past between Okinawajima and Emi-Oshima at 6 a. m. of the 6th with the barometer showing a pressure of 735 millimeters. The center of the depression then moved northeastward and approached the southern coast of Kii at 6 a. m. of the 7th. Thence it moved toward Nagoya and past thru Honshu entering the Japan Sea. According to the Omori seismograph at Osaka Observatory, the pulsatory oscillations became more frequent as the depression approached and were recorded in in the greatest numbers on the evening of the 7th, the amplitude of the east-west component being 0.06 millimeter, and that of the south-north component 0.07 millimeter. As the depression past away northeastward the pulsatory oscillations gradually decreased.

The barometric depression of July 22-28, 1906, which past over the southern and southeastern coasts of Japan, the depression of December 20-24, 1907, which past eastward over the Japan Sea, and the barometric depression of August 22-28, 1908, which moved from the eastern China Sea across the Yellow Sea and then toward Siberia, not only confirm the above statement but also prove that when there is a strong barometric gradient the number of pulsatory oscillations of the earth's crust is greatly increased.

We next made some study of the relation between the wind and the pulsatory oscillations, but we could hardly find any such relation.

RESEARCHES ON THE SOLAR CONSTANT AND THE TEMPERATURE OF THE SUN.

By Dr. J. Scheiner, Potsdam, Berlin.

[Extract from Monthly Notices, Royal Astronomical Society, 1908, 68:662.]

The measurements of the sun's radiation were made with the Ångström electric compensation pyrheliometer, to which I had given a modified exterior form and a parallactic motion with clockwork. On eleven days in June and July, 1903, I made a long series of observations on the summit of the Görner Grat, Canton Wallis, Switzerland, from which I could derive the radiation of the sun outside our atmosphere. This part of the problem is the most difficult one, and according to my view it can not be solved from measurements of the solar radiation alone. From such observations a portion only of the real solar constant can be obtained, because only that portion of the loss by absorption in our atmosphere can be calculated which is based upon the *continuous* increase of absorption with growing thickness of the atmosphere traversed by the radiation. With carbon dioxide and water vapor there exists a nearly sudden absorption in the highest thin layers of the atmosphere, which must be treated as a constant to be added to the radiation-curves. Therefore this latter result is not the solar constant as generally supposed, and I have chosen for it the term "Strahlungs-konstante" or "constant of radiation."

From my observations on the Görner Grat it amounts to 1.95-2.02 gram-calories. The remaining constant, which must be added to it in order to obtain the solar constant, can be found only from experimental researches in the laboratory. To this part of the problem I have devoted much labor in measuring the absorption of carbon dioxide and superheated water vapor with varying depth of layer.

This very complicated research can not be described in a short abstract, and I must therefore refer the reader to the original paper. The result is that to reduce the "constant of radiation" to the solar constant there must be added for carbon dioxide 1 per cent, for water vapor 7 per cent, and for the ultraviolet absorption 1.5 per cent, whence the solar constant for the unit of distance is found to be 2.22-2.29 gram-calories, with a probable error of 2 per cent.

THE BLANKET EFFECT OF CLOUDS.

By Dr. W. W. Coblentz, Ph. D. Dated Washington, D. C., February 12, 1909.

In the various discussions of meteorological and geological phenomena, the "greenhouse" and "blanket" effect of clouds in conserving terrestrial temperature seems to have been pushed to the limit without considering the functions that clouds can perform.

First of all, water is the most opaque substance known for infra-red radiation, but it is very transparent for light waves. It belongs to the class of substances known as "insulators" or "transparent media," in which the reflecting power is a function of only the refractive index, the absorption coefficient (altho high for water as compared with other transparent media) being still too low to affect the reflecting power. This means that since the refractive index of water is low, the reflecting power is low. Indeed water is unique in this respect, for it has no marked bands of metallic reflection such as obtain in quartz, glass, and various other minerals. The reflecting power of a plane surface of water is less than 8 per cent thruout the spectrum to 20μ, and in the regions where there are no absorption bands the reflecting power is much less, even as low as 2 per cent.

Let us now consider what must be the behavior of water in the form of clouds. The albedo of clouds for sunlight is more than 60 per cent. The value of the refractive index shows that the reflecting power can not be much above 2 per cent, and the high value of 60 per cent must occur as a result of scattering at the surface of the water globule and of internal reflection.

In the infra-red there can be but little internal reflection due to the great opacity of the water globule for heat waves. Hence the reflecting power must remain low, and of the same magnitude as that of a plane surface, viz, from 2 to 5 per cent. If water had bands of strong selective reflection in the infra-red the albedo of clouds might be higher than the above estimates.

The "blanket" effects of clouds must therefore be due principally to their high emissivity (for those radiations emitted by the earth) hence to their high efficiency as a heat radiator. By definition the Kirchhoff radiator (so-called "black body") is one in which the reflecting power is *nil* and which is perfectly opaque. Water fulfills this first condition to within 2 to 5 per cent (depending upon the wave-length) and the second condition to such an extent that a layer 1 cm. thick absorbs completely all radiation of wave-length greater than 1.5μ in the infra-red. In the region of 8μ, where lies the earth's maximum emission, less than 1 mm. thickness of water is required to produce complete opacity. The "blanket"

[1] Abstract in English, reprinted from Journal Meteorological Society, Japan, September, 1908, 27th year, No. 9, p. 25-6.